JESIUM 2012 "Joint European Stable Isotope Users Group Meeting" 2-7 September 2012. Leipzig . Germany. (p. 272)

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Identification of metabolites involved in leaf and bunch edification using $^{12}C/^{13}C$ on oil palm trees in North Sumatra.

Poster - Jesium 2012

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Oil palm (*Elaeis guineensis* Jacq.) is one of the most productive perennial crops in the world with maximal yield at around 40 t ha^{-1} of fresh fruit bunches. To ensure such a high yield (harvesting up to 50 kg per bunch), oil palm owns high photosynthetic rate (until 30 µmol m^{-2} s^{-1}) related to a continuous leaf emission all along the year, important standing biomass (50 t/ha) and high carbon allocation to the fruits. The understanding of the main metabolic pathways involved in bunch elaboration is a very important goal in oil palm agronomical research. Meristem zone (palm heart), trunk and roots seem to be important sinks for carbon reserves, which could be remobilized during fruit development and leaf emission. In that context, the use of the carbon isotope discrimination ($^{12}C/^{13}C$) could be a useful tool for identifying the main metabolites responsible for vegetative and reproductive growth of the oil palm trees. Samplings were done on clonal material (adult trees of ten years old, issued from crossing *, clone* “MK60”, *Dura* x *Pisifera,* Aek Pancur Research Station North Sumatra, Indonesia) on leaves (leaflets, rachis and petiole) during their development, trunks (palm heart, terminal buds, meristem zone and upper, middle and bottom parts of the trunks), roots (primary, secondary, tertiary+absorbant roots) and on bunch components (rachis, fruits and spikelet). Metabolic (soluble sugars and starch contents) and isotopic analyses were performed at the Metabolism-Metabolom platform in Orsay. From starch and sugar contents and the respective $\delta^{13}C$ values as well as $\delta^{13}C$ of bulk organic matter of all organs studied, some hypotheses concerning general pattern of carbon allocation at tree level have been merged : at the leaf level, from “rank -6” to “rank 1” (rank 1 : full expansion of the leaflets, passage from heterotrophy to autotrophy), clearly sucrose and starch (and their transitory phases) are mostly used for leaf growth. The carbon reserve pool used for leaf development is located at the meristem zone (palm heart) and in the petioles. Concerning bunches, it seems

that glucose and starch are involved in the oleosynthesis processes during fruits development. Starch content in fruits during their filling (3 months after pollination) is higher (maximum of 39.33 ± 1.4 mg g^{-1} DM) compared to soluble sugars, it then decreases during oleosynthesis. During fruit growth, simultaneously with the starch decrease from stage 3 to 6, lipid content increases quickly until maturation (with a maximum lipid content of 80 mg g^{-1} DM). The starch used for fruit development could be originated from the important glucose pool located at the bottom of the trunk. The ^{13}C depletion in starch ($\delta^{13}C$ from -24.4 ‰ at stage 1 to -25.8 ‰ at stage 6 corresponding to pollination and fruit maturation, respectively) indicates possible utilisation of new photosynthetic products during fruit filling. Strong ^{13}C depletion (-31‰) observed on fruit bulk organic matter during maturation is related to lipid synthesis. The role of the root system in the remobilisation of starch for bunch edification is not clarified yet thorough our results.